BIOTIC COMMUNITY

Fish Community Information

The fishes of the Headwaters Diversion Basin have been sampled extensively with seines and electrofishing equipment since 1940. Well distributed collection data are available from 85 seine sites (Pflieger et al. 1981 and McCord 1985), 4 private collection sites (MDC Natural History data base) and 17 electrofishing sites (Fisheries District). Site information and species specific site occurrences were tabulated and mapped (Tables 1-B, 2-B and Figure fs). Sample site number and letter designations were assigned by Fisheries District staff and are not related to the five digit site code used by MDC Fisheries Research staff. Stream orders and river mile distances were meticulously determined by Fisheries District staff and do not always agree with MDC Fisheries Research computer records.

Seine samples, based on purpose, techniques, methods and gear specifications described by Pflieger (1991), currently provide the qualitative and quantitative indicators that can best define entire fish communities. The seine data were organized by families of fishes. However, electrofishing samples based on boat-mounted DC equipment with a minimum station length of two miles and three hours of gear time, emphasized the collection of species which could have some angling value. No attempt was made to collect nektonic or benthic fish species. Electrofishing data were organized by groups of fishes which might generate similar angling interests or share similar management concerns.

The Headwaters Diversion Basin is contained within the Ozark-Southeast Division of the Ozark Faunal Region. This division contains no unique fish species and is actually characterized by combinations of peripherally distributed species found in seven adjacent divisions representing three faunal regions (Pflieger 1989). Consequently, the small basin supports a particularly diverse assemblage of fishes; 19 families and 113 species have been identified in seine and electrofishing collections (Table 14).

Seine Data

The number of species appearing in seine hauls has steadily increased since the 1940 sampling efforts where only 69 species were recorded from 11 sites. By the 1980's, 94 species were identified at 85 sites. The extirpated pallid shiner (*Notropis amnis*) and the watch-listed pugnose minnow (*Opsodoedus emiliae*) are the only species that have not appeared in post-1940 collections. Four low-density species that appeared in extensive sampling efforts (63 sites) during the 1960's and 1970's but did not appear in the 1980's collections are: blacktail shiner (*Cyprinella venustus*), bluntnose darter (*Etheostoma chlorosomum*), stippled darter (*Etheostomapunctulatum*) and blackstripe topminnow (*Fundulus notatus*). The blacktail shiner and bluntnose darter are Lowland, turbid water species which no longer have easy access into the basin. The stippled darter is a disjunct species with a distribution typically limited to the west side of the Ozarks; and, the blackstripe topminnow (*Fundulus olivaceus*), which is the most frequently occurring fish in the basin.

The apparent increase in species richness from 69 to 94 species over a period of 50 years is probably attributable to improved sampling methods and skills by more knowledgeable collectors. It is doubtful that habitat and channel conditions could have improved in the last 50 years to allow species diversity to expand by 25 new species. It is encouraging to note that the basin appears to have lost only two species since 1940.

Species Composition.

The composition of subbasin fish communities are not similar, which accounts for the variable distribution and frequency of occurrence of species within the basin. The Castor River, Crooked Creek, Whitewater River and the Diversion Channel subbasins share only 22 of the 92 species identified in seine hauls (Table 15). Even the Castor River, Crooked Creek and the Whitewater River drainages, which provide adjacent and similar channel elements for longitudinal species succession, share only 45 species. Apparently, longitudinal species succession is not a factor in the homogeneous habitats found in the Diversion Channel, which may account for the reduced species diversity in the lower part of the basin. No single species is the most frequently occurring fish in all subbasins (Table 15). The blackspotted topminnow is probably the most ubiquitous species in the basin and appears at nearly 90 percent of all sample sites on the Castor and Whitewater rivers. However, depending on the subbasin, redfin shiner (*Lythrurus umbratilis*), striped shiner (*Luxilus chrysocephalus*), bleeding shiner (*Luxilus zonatus*), bigeye chub (*Notropis boops*) and longear sunfish (*Lepomis megalotis*) are widely distributed species than can be present at more than 75 percent of the sites in some drainages. At least 12 other common species can be expected to occur at 50 percent of the sites in the basin.

Due to the unique subbasin species distributions, management considerations, particularly those relating to nektonic and benthic fishes, may need to focus on specific localities within the basin and not necessarily on particular species throughout the basin. Site management may produce more consequence than species management.

Relative Abundance.

The relative abundance within subbasin fish communities, especially at the family level, are quite similar (Table 15). Castor River, Crooked Creek and Whitewater River have nearly identical minnow, sunfish and darter components (descending order of dominance) that account for about 90 percent of the community densities. The dominant order of component densities in the more sluggish Diversion Channel, however, is sunfish, darter and minnow which total about 70 percent of the community numbers. Variation in the order of abundance of particular species within a family is apparently related to subbasins. The Ozark minnow (*Notropis nubilus*), bluntnose minnow (*Pimephales notatus*) and bleeding shiner are probably the three most abundant species in the basin and are definitely the most abundant fish in the Castor and Whitewater subbasins.

The bluntnose minnow is also the most abundant species in Crooked Creek, followed by the speckled darter (*Etheostoma stigmaeum*) and largescale stoneroller (*Campostoma oligolepis*) which are absent or minor components in the other subbasins. The Diversion Channel community is dominated by

the cypress darter (*Etheostoma proeliare*), redfin shiner and pirate perch (*Aphredoderus sayanus*), which occur in low numbers in the other subbasins. Longear sunfish occur at moderate densities throughout the basin and bluegill (*Lepomis macrochirus*) are important only in the Diversion Channel.

Benthic and nektonic species are probably quantified better by seine samples than larger, longer-lived fish species, especially those catfish, sunfish and sucker species that attract most of the angling and resource management attention. Seine data, however, can indicate the presence, possible nursery locations and maybe even the relative abundance of the juveniles of large species that seldom appear in boat-mounted electrofishing collections.

Electrofishing Data

Boat-mounted electrofishing efforts, directed at only large or easily dipped species, (Table 17) resulted in the collection of six families and 18 additional species. Ten of the additional species are members of the gar, herring, sea bass, paddlefish, eel and drum families. Four long-fin sucker species (*e.g.* buffaloes), walleye (*Stizostedionvitreum*), sauger (*S. canadense*), black crappie (*Pomoxis nigromaculatus*) and a single goldfish (*Carassius auratus*) were collected exclusively with electrofishing gear. Species composition appears to be a useful parameter which tends to be independent of electrofishing variables. The standard deviation of replicate site samples is small and most of the variation is accountable in the gizzard shad (*Dorosoma cepedianum*) portion of the sample. The standard deviations of site relative densities (electrofishing catch rate), however, are quite large and are probably caused by temporal and physical variables.

Species Composition.

Basin fish communities are good examples of longitudinal succession. Species diversity decreases with increased elevations and gradient which promotes some species such as longear sunfish, shadow bass (*Ambloplites ariommus*), green sunfish (*Lepomiscyanellus*), smallmouth bass (*Micropterus dolomieu*) and the short-fin suckers (eg. redhorse spp.) to dominance in the upper watersheds; while bluegill, spotted bass (*Micropterus punctatus*), crappies and the long-fin suckers tend to dominate the communities lower in the watersheds.

Spotted bass is the predominant black bass (85 to 90% of EF samples) throughout most of the basin. Spotted bass begin to avoid gradients steeper than 12 ft/mile and are totally replaced by smallmouth bass (80 to 90%) in the upper watersheds at gradients greater than 14 ft/mile. The composition of largemouth bass (*Micropterus salmoides*) (6 to 10%) is fairly uniform throughout the basin and appears to be independent of elevation and gradient. A single significant concentration (99%) of largemouth bass occurs at the confluence of the Diversion Channel and Mississippi River. Further upstream in the Diversion Channel (10 to 20 miles), juvenile spotted bass dominate the black bass component. The concentration of juvenile spotted bass in the altered Diversion Channel, however, is probably a result of flood displaced fish trapped downstream of the Blockhole grade control structure, which functions as a 10-ft high barrier (falls) during normal flows.

Angler Guide.

Most smallmouth bass throughout the basin are <12", however, Master Angler size fish (≥ 17 " have been collected in good numbers from the Middle Castor River and Whitewater River.

The largemouth bass size structure is considerably better than the other black bass species. Body condition and growth are also better. Because largemouth bass densities are low, negative population responses to spotted bass management efforts should not become an issue or consequence in most of the basin. An exception is the extreme lower reaches of the Diversion Channel where largemouth bass management concerns (because of high densities) should definitely take precedence over the other black bass species.

Shadow bass size structures throughout the basin include a high proportion of fish longer than seven inches. Preferred-size fish (\geq 12"), however, are fairly uncommon. Growth rates are above average (Carlander, 1977), densities are low and longevity is evident, which suggests that the large difference between PSD and RSD parameters is probably related to angler exploitation. Harvest restrictions could regulate angler exploitation if overfishing or high angler use can be demonstrated.

The dense, slow growing subbasin populations of longear sunfish produce few quality-size fish (6 inches long) and virtually no fish longer than eight inches. Most longear sunfish do not live long enough (age 6) to reach six inches long. Unless it can be demonstrated that anglers are willing to harvest abundant and easily caught small panfish, the contributions of the longear sunfish populations to the basin are probably more related to the ecology of the stream system than to providing angling opportunity.

Bluegill are providing an excellent fishery in the lower Diversion Channel subbasin. An outstanding size structure, which includes some fish eight inches long, and growth rates that produce fish six inches long in three years, are characteristic of the lower basin where competition with other sunfishes is minimal. Elsewhere in the basin, a high proportion of bluegill reach six inches in length (and sometimes 8 inches), however, densities are low and the species cannot be expected to contribute significant numbers to the creel.

Channel and flathead catfish size structures are represented by excellent proportions of fish 16 and 24 inches long. Most of the catfish captured by standard electrofishing and one-inch mesh hoopnets in all District 11 basins have reached stock-size (11 inches long) and few juvenile catfish, of any species, are ever observed. The best bet for anglers are the lower portions of the Castor River and the Diversion Channel.

Anglers certainly rate the quality of fishing on the Castor River as being considerably better than the Diversion Channel. Catfish are the only species that anglers on the Castor River rate below 5.0 (on a 10-point scale where 10 is the best). Diversion Channel anglers rate all species, except carp, below 5.0. It is important to note that catfish anglers are the least satisfied anglers on both streams, and the large contingent of crappie anglers on the Diversion Channel rate the fishery as poor (2.6).

Anglers on both streams release a significant portion of their total catch (Castor River 49%; Diversion Channel 59%). Bass anglers on both streams release about four out of five bass caught and Diversion

Channel crappie anglers release one out of three crappie caught.

The species composition of the total catch generally parallels angler preference effort. Exceptions are a high proportion of sunfish in the total catch on both streams, and a low proportion of catfish in the total Castor River catch. About 90 percent of the total Castor River catch is represented by (in descending order): sunfish, bass, shadow bass and catfish. Ninety percent of the total Diversion Channel catch is composed of: crappie, catfish, carp, sunfish and freshwater drum.

Species of Conservation Concern

No federally listed (USFWS Endangered Species Act) threatened or endangered fish occur in the basin. The state of Missouri, however, lists the status of 10 basin fishes as either Rare (4 species), Extirpated (1 species) or Watch List (5 species). The extirpated pallid shiner (*Notropis amnis*) and the watch listed pugnose minnow (*Opsodoedusemiliae*) have not been collected in the basin since 1941. The other eight threatened species have been sampled or identified more recently (Table 22).

None of the threatened species are unique to the Ozark-Southeast faunal community, which is the dominant Division in the Headwaters Diversion Basin. Parts of three bordering faunal divisions are responsible for the diversity and distribution of the threatened species. The lake chubsucker (*Erimyzon sucetta*), Eastern slim minnow (*Pimephalestenellus pariceps*), scaly sand darter (*Ammocrypta vivax*), flier (*Centrarchus macropterus*), American brook lamprey (*Lamperta appendix*), pugnose minnow and pallid shiner are all largely confined to the Lowland-Flowing Water Division. The silverjaw minnow (*Notropis buccatus*) is definitely restricted to the Ozark-Mississippi 1 Subdivision; the blacknose shiner (*Notropis heterolepis*) is associated with the Prairie-Lower Missouri Division; and the paddlefish (*Polyodonspathula*) migrates out of the Big River-Overflow Waters Division.

The distribution of threatened fish species within the basin is significant. Twenty-one of the 27 sample sites where 8 of the 10 threatened fish species have been found are concentrated in two specific stream reaches on the Castor and Whitewater Rivers (see <u>UniqueHabitat</u> section). The Castor River reach also contains all five of the state or federal threatened naiad species that have been collected in the basin. Both of these particular stream reaches are located within the peripheral edges of the overlapping Ozark-Southeast and the Lowland-Flowing Water Faunal Divisions. The Whitewater River reach may also include some Ozark-Mississippi 1 Subdivision influence, as evidenced by the fairly common occurrence and abundance of the silverjaw minnow. Basin management decisions and efforts will certainly need to emphasize these two river reaches when considering the protection of threatened species and associated habitats.

Aquatic Invertebrates

The aquatic invertebrate community has been sporadically surveyed by various MDC collectors using specialized sampling methods and reporting techniques. Survey results are in the MDC Natural Heritage data base.

Thirty-seven species of naiades were collected in the basin by Ronald Oesch and Al Buchanan

between 1978 and 1983 (Table 23). Five naiad species are state listed as rare or endangered: elephant ear (*Elliptio dilatata*), Western fanshell (*Cyprogeniaaberti*), Southern hickorynut (*Obovaria jacksoniana*), snuffbox (*Epioblasmatriquetra*) and Curtis pearlymussel (*Epioblasma f. curtisi*). The Western fanshell and Curtis pearlymussel also have a federally endangered status. All five of the threatened naiad species have been collected in a reach of the Castor River between RM 1 and RM 12. The Southern hickorynut has also been collected in Crooked Creek at RM 21 and at an unknown site on the Whitewater River.

The mucket (*Actinonaias l. carinata*) is a commercially important naiad species that is quite common throughout the basin and comprises about 31 percent of the total species composition. The buckhorn (*Tritogonia verrucosa*), black sandshell (*Ligumia recta*) and yellow sandshell (*Lampsilis teres*) are also commercially important species, but occur only in low densities (usually <1% of the total species composition). The lady finger (*Elliptio dilatatus*), which has no commercial value, is the most commonly occurring species in the basin and accounts for about 46 percent of the naiad species composition.

Eight species of crayfish were collected in the basin by William Pflieger between 1984 and 1987 (Table 24). Crayfish abundance is definitely dominated by Ozark Faunal Region species; however, it is the presence of the Lowland species that is responsible for the diversity of the crayfish community.

One hundred-twenty three benthic taxa were identified in the basin by Frank Ryck and Linden Trail during 1975 and 1976. The mayflies (Ephemeroptera), stoneflies (Plecoptera), caddisflies (Trichoptera), aquatic beetles (Coleoptera) and midges (Diptera) account for about 87 percent of the benthic abundance and 76 percent of the taxa diversity (Table 25). The composition and diversity of the benthic community are indicative of good water quality.

Wetland Species

The basin contains a diverse wetland fauna, which, again, is indicative of the broad spectrum of habitats that are available in the basin. Recent guidelines for managing wetland resources (MDC 1993c) identify 87 species of fishes, naiades and crayfishes that tend to inhabit wetlands during part of their life cycle. Sixty-three of these designated wetland species have been collected in the basin (Table 26).

Opportunities to take advantage of the many remnant wetland populations may be present in the lower basin, even though specific information related to the management and habitat requirements of wetland species is limited. Acquisition of low lying areas (particularly the old Dark Cypress Swamp) and then the creation of frequently flooded slackwaters with numerous mainstream channel connections would do much to replace some of the wetland habitats lost to agricultural land improvements.

Fish Introductions and Stockings

There are no known records of any authorized resource agency introduction or supplemental stocking

of exotic or native fishes in the streams of the basin. However, lentic water overflow, bait bucket distribution and immigration of extrinsic fishes do occur, as evidenced by the unusual presence of redear sunfish (*Lepomis microlophus*), fathead minnow (*Pimephales promelas*), goldfish and bighead carp (*Hypophthalmichthysnobilis*) in an occasional fish sample.

Commercial Harvest

The only commercial fishing opportunity in the basin is limited to 0.6 mile of overflow flood water near the mouth of the Diversion Channel (less than 150 acres). Adequate flood conditions (approximately 36 ft on the Cape Girardeau gage), which allow legal and effective deployment of commercial gear, usually only last about two weeks each year. The commercial harvest of fish in the remainder of the basin is illegal and probably insignificant. Commercial fishing interest and activity on the adjacent Mississippi River in Cape Girardeau County is low and on the decline.

The 1990 Mississippi River species composition (by weight) of the reported Cape Girardeau County total commercial catch was: (in descending order) buffalo, paddlefish, carp and blue catfish. It is not likely that significant numbers of paddlefish would concentrate in the shallow overflow flood waters.

Other Management And Research Efforts

On the middle Whitewater River, McCord (1986) tried to test several proven hypotheses relating longitudinal succession of fish community structures to the variables of: habitat volume, habitat depth and physicochemical conditions. Multiple seine and backpack electrofishing samples were collected between February 1985 and February 1986. The results did not support the hypotheses and the study was inconclusive.

The Long Term Resource Monitoring Program (LTRM) established a fish component sampling site on the lower Diversion Channel at RM 0.7 in 1992. Samples are collected during three periods between June and October with gillnets, fyke nets, minnow fyke nets, hoopnets and boat-mounted electrofishing equipment. The primary information collected relates to community structure: percent composition, relative abundance, length, weight and possibly some centrarchid and ictalurid age and growth. The LTRM also monitors for the zebra mussel (*Dreissena polymorpha*) at this site, and may eventually add an invertebrate monitoring component.

Present Regulations

Statewide stream fishing regulations (creel limits, size limits, methods and seasons) apply to most of the streams in the basin. Exceptions to the statewide stream regulations that refer to specific areas on the Diversion Channel are:

3CSR 10-6.310 (2) Sport Fishing Seasons: Seasons, Limits.

Black bass may be taken throughout the year on the Diversion Channel from the mouth of the Diversion Channel at the Mississippi River to the Missouri Highway 77/25 bridge (RM 8.5).

3CSR 10-10.725 (1) Commercial Fishing: Seasons and Methods. Commercial fishing is allowed on the

Diversion Channel, only in the temporary Mississippi River overflow waters, from the mouth of the Diversion Channel at the Mississippi River to the Union Pacific Railroad bridge (RM 0.6).

No changes in fishing regulations or the establishment of special stream management areas are planned at this time.

Most captured carp, throughout the basin, are typically more than 16 inches long and carp less than 11 inches long have never been sampled anywhere in the basin. The Whitewater River subbasin, in particular, produces large carp -- where individuals approaching memorable-size (26 inches long) are common.

Freshwater drum, in the Castor River, is the only species that tends to have a size structure influenced by position in the watershed. Larger individuals are more frequently captured (electrofishing) in the steeper gradients of the upper watershed. Improved gear efficiency in the clearer and shallower pools may be a factor. Preferred-size fish (15 inches long) are quite common and memorable-size fish (20 inches long) are occasionally caught.

Golden redhorse occur at remarkably similar densities in the Castor River, Whitewater River and Crooked Creek subbasins; however, the subbasin size structures of golden redhorse are considerably different. The Whitewater River typically produces large fish and Crooked Creek produces particularly small fish. The size of the Castor River fish appears to be intermediate. The Whitewater River watershed is probably the most fertile and Crooked Creek definitely has the least fertile watershed in the basin. Unfortunately, comparative age and growth information is not yet available. Possibly more significant is the fact that Crooked Creek is the clearest stream and Whitewater River is the most turbid stream in the basin. Gigging exploitation on Crooked Creek or under-utilization by anglers on Whitewater River may be factors that are influencing the size structures of golden redhorse populations.

Creel Data

The Missouri State-Wide Angler Survey (Weithman, 1991) is the only source of creel information for the basin. Accurate estimates of total angler pressure, catch and harvest are not likely obtainable in small, low-use basins where the number of anglers interviewed is low (403 anglers during the six-year survey period). However, the raw survey data which partitions angler species preference, effort, success and satisfaction can provide some inferences that describe angler utilization of the fishery resource.

Two of the more popular Headwater Diversion Basin streams are reported in the State-Wide Angler Survey: The smaller $(4^{\circ}, 5^{\circ}, 6^{\circ})$, rural, free flowing, clear, Castor River in the upper basin; and, the larger $(6^{\circ}$ and $7^{\circ})$, urban, channelized, turbid, Diversion Channel in the lower basin. Differences in angler effort and success are quite apparent between the two contrasting streams and fish communities (Tables 20 and 21).

Most of the angling effort on both streams is nonspecific ("Anything"). Species-specific anglers seek

mostly black bass, catfish and sunfish on the Castor River; while carp, crappie and catfish dominate the effort on the Diversion Channel. Catfish is the only species that shared a relatively high common effort on both streams.

Catfish angler catch rates are higher on the Castor River than on the Diversion Channel and bass angler catch rates are higher on the Diversion Channel. The total overall angler catch and harvest rates on the Castor River appear to be much higher than on the Diversion Channel. The higher overall success on the Castor River, however, is probably inflated by the abundance of longear sunfish available to the nonspecific angler. Also, the less abundant crappie probably deflates the success of the Diversion Channel nonspecific angler.

Table 14. Species list of all fishes collected in the Headwaters Diversion Basin by MDC personnel (X), University studies (U) and recognized private collectors (P). State threatened species status is indicated.

	To 1 1 10 10 10 10 10 10 10 10 10 10 10 10		Dec	ade Colle	ected	
	Family/Species	1940	1960	1970	1980	1990
	PETROMYSONTIDAE (LAMPREYS)					
	Ichthyomyzon castaneus (Chestnut lamprey)		X		X	
	I. (Ammocoete) (larvae)		X	X	X	
RA	Lampetra appendix (American brook lamprey)			X		
	L. aepyptera (Least brook lamprey)				U	
	POLYODONTIDAE (PADDLEFISH)					
WL	Polyodon spathula (Paddlefish)				X	
	LEPISOSTEIDAE (GARS)					
	Lepisosteus oculatus (Spotted gar)				X	
	L. osseus (Longnose gar)				X	
	L. platostomus (Shortnose gar)				X	
	AMIIDAE (BOWFINS)					
	Amia calva (Bowfin)		X		X	
	ANGUILLIDAE (EELS)					
	Anguilla rostrate (American eel)				X	
	CLUPEIDAE (HERRINGS)					
	Alosa chrysochloris (Skipjack herring)				X	
	Dorosoma cepedianum (Gizzard shad)				X	
	ESOCIDAE (PIKES)					
	Esox a. vermiculatus (Grass pickerel)	X	X		X	
	CYPRINIDAE (MINNOWS)					
	Campostoma anomalum (Central stoneroller)	X	X	X	X	
	C. oligolepis (Largescale stoneroller)	X	X	X	X	
	Carassius auratus (Goldfish)				X	
	Cyprinella lutrensis (Red shiner)	X			X	
	C. venusta (Blacktail shiner)	X	X	X		
	C. whipplei (Steelcolor shiner)	X	X	X	X	
	Cyprinus carpio (Common carp)		X		X	
	Hybognathus nuchalis (Miss. Silvery minnow)	X			X	
	Hypophthalmichthys nobilis (Bighead carp)				X	
	Luxilus chrysocephalus (Striped shiner)	X	X		X	
	L. zonatus (Bleeding shiner)	X	X	X	X	
	Lythrurus fumeus (Ribbon shiner)	X		X		
	L. umbratilis (Redfin shiner)	X	X	X	X	
	Nocomis biguttatus (Hornyhead chub)	X	X		X	
<u> </u>	Notemigonus crysoleucas (Golden shiner)	X	X		X	
EX	Notropis amnis (Pallid shiner)	X				
	N. amblops (Bigeye chub)	X	X	X	X	
	N. atherinoides (Emerald shiner)	X			X	
****	N. boops (Bigeye shiner)	X	X	X	X	
WL	N. buccatus (Silverjaw minnow)	37	X	37	X	
D 4	N. greenei (Wedgespot shiner)	X	X	X	X	
RA	N. heterolepis (Blacknose shiner)		P			

		Family/Charies		Dec	<mark>ade Colle</mark>	ected	
		Family/Species	1940	1960	1970	1980	1990
	N.	nubilus (Ozark minnow)	X	X	X	X	
	N.	rubellus (Rosyface shiner)	X	X	X	X	
	N.	telescopus (Telescope shiner)	X	X	X	X	
	N.	volucellus (Mimic shiner)	X	X	X	X	
WL	Ops	opoeodus emiliae (Pugnose minnow)	X				
	Phe	nacobius mirabilis (Suckermouth minnow)	X			X	
	Pho	xinus erythrogaster (Southern redbelly dace)		X		X	
	Pim	ephales notatus (Bluntnose minnow)	X	X	X	X	
	P.	promelas (Fathead minnow)				U	
RA	P.	tenellus parviceps (Eastern slim minnow)	X	X		X	
	P.	vigilax (Bullhead minnow)	X	X	X	X	
	Sem	otilus atromaculatus (Creek chub)	X	X		X	
		CATOSTOMIDAE (SUCKERS)					
	Car	piodes carpio (River carpsucker)		X		X	
	C.	cyprinus (Quillback)				X	
	Cate	ostomus commersoni (White sucker)				X	
	-	nyzon oblongus (Creek chubsucker)	X	X	X	X	
RA	E.	sucetta (Lake chubsucker)		P			
	+=-	entelium nigricans (Northern hog sucker)	X	X	X	X	
		bus bubalus (Smallmouth buffalo)				X	
	I.	cyprinellus (Bigmouth buffalo)				X	
	I.	niger (Black buffalo)				X	
	+	ytrema melanops (Spotted sucker)	X	X	X	X	
	_	costoma anisurum (Silver redhorse)	X	X	71	X	
	M.	carinatum (River redhorse)	X	X		X	
	M.	duquesnei (Black redhorse)	X	X	X	X	
	M.	erythrurum (Golden redhorse)	X	X	X	X	
	M.		X	X	Λ	X	
	IVI .	macrolepidotum (Shorthead redhorse)	Λ	Λ	1	Λ	
	1	ICTALURIDAE (CATFISHES)					
	_	iurus melas (Black bullhead)	X	X		X	
	A.	natalis (Yellow bullhead)	X	X		X	
	_	lurus punctatus (Channel catfish)	X	X		X	
	_	urus exilis (Slender madtom)	X	X		X	
	N.	gyrinus (Tadpole madtom)	X			X	
	N.	miurus (Bridled madtom)	X	X	X	X	
	N.	nocturnus (Freckled madtom)			X	X	
	_	odictis olivaris (Flathead catfish)				X	
	A	PHREDODERIDAE (PIRATE PERCHES)					
	Aph	redoderus sayanus (Pirate perch)	X	X	X	X	
		CYPRINODONTIDAE (KILLFISHES)					
	Fun	dulus catenatus (Northern studfish)	X	X	X	X	
	F.	notatus (Blackstripe topminnow)		X	X		
	F. olivaceus (Blackspotted topminnow) POECILIIDAE (LIVE BEARERS		X	X	X	X	
	Gan	abusia affinis (Western mosquitofish)	X	X	X	X	
	Jun	ATHERINIDAE (SILVERSIDES)	23		21	21	
	Lab	idesthes sicculus (Brook silversides)	X	X	X	X	
	Lab	COTTIDAE (SCULPINS)	Λ	Λ	Λ	Λ	
	0-4	<u> </u>	+	v	 	<u> </u>	
	Coti	tus carolinae (Banded sculpin)	+	X	v	v	
	U.	hypselurus (Ozark sculpin)	1	X	X	X	

	Formily/Crossing		Dec	Decade Collected							
	Family/Species	1940	1960	1970	1980	1990					
	PERCICHTHYIDAE (SEA BASSES)										
	Morone chrysops (White bass)				X						
	M. mississippiensis (Yellow bass)				X						
	CENTRARCHIDAE (SUNFISHES)										
	Ambloplites ariommus (Shadow bass)	X	X	X	X						
WL	Centrarchus macropterus (Flier)	71	71	X	X						
*** E	Elassoma zonatum (Banded pygmy sunfish)			X	X						
	Lepomis cyanellus (Green sunfish)	X	X	X	X						
	L. gulosus (Warmouth)	X	X	X	X						
	L. humilis (Orangespotted sunfish)	X	X	X	X						
	L. macrochirus (Bluegill)	X	X	X	X						
	L. megalotis (Longear sunfish)	X	X	X	X						
	L. punctatus (Spotted sunfish)	X	X	X	X						
	Micropterus dolomieu (Smallmouth bass)	X	X		X						
	M. punctulatus (Spotted bass)	X	X	X	X						
	M. salmoides (Largemouth bass)	X		X	X						
	Pomoxis annularis (White crappie)				X						
	P. nigromaculatus (Black crappie)				X						
	PERCIDAE (PERCHES)										
WL	Ammocrypta vivax (Scaly sand darter)	X	X		X						
	Etheostoma blennioides (Greenside darter)	X	X	X	X						
	E. caeruleum (Rainbow darter)	X	X	X	X						
	E. chlorosomum (Bluntnose darter)	X	X	X							
	E. flabellare (Fantail darter)	X	X	X	X						
	E. gracile (Slough darter)		X		X						
	E. histric (Harlequin darter)					X					
	E. nigrum (Johnny darter)	X	X	X	X						
	E. proeliare (Cypress darter)		X	X	X						
	E. punctulatum (Stippled darter)		X								
	E. spectabile (Orangethroat darter)	X	X		X						
	E. stigmaeum (Speckled darter)	X	X	X	X						
	E. zonale (Banded darter)	X	X	X	X						
	Percina caprodes (Logperch)	X	X	X	X						
	P. shumardi (River darter)	X	X	X	X						
	P. sciera (Dusky darter)	X	X	X	X						
	P. vigil (Saddleback darter)			X	X						
	P. maculata (Blackside darter)	X	X	X	X						
	Stizostedion canadense (Sauger)				X						
	S. vitreum (Walleye)				X						
	SCIAENIDAE (DRUMS)										
	Aplodinotus grunniens (Freshwater drum)				X						

TABLE 15. Species distribution, occurrence and composition in the Headwaters Diversion Basin, Missouri. From a total of 85 seine sites (% OCURR) of which 35 samples were enumerated (% COMP) by Pflieger and McCord.

		CASTO	R RIV	CROOK	ED CK	WHITE	<u>WATER</u>	D. CHA	NNEL	TOTAL I	BASIN
		<u>No. 8</u>	<u>Sites</u>	<u>No. 5</u>	<u>Sites</u>	No. S	<u>Sites</u>	<u>No. S</u>	lites_	<u>No. 5</u>	<u>Sites</u>
	Family/	24	15	22	3	24	12	11	5	85	35
	Species	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
		OCCUR	COMP	OCCUR	COMP	OCCUR	COMP	OCCUR	COMP	OCCUR	COMP
				PETROM	YSONTIDA	AE (LAMPI	REYS)				
	chthyomyzon aneus (Chestnut lamprey)	8	<0.1							2	<0.1
I.	(Ammocoete) (larvas)	8	<0.1			4	<0.1			3	<0.1
	mpetra appendix american brook lamprey)	4	0.3							1	0.1
L.	aepyptera (Least brook lamprey)					4	<0.1			1	<0.1
				<u>Al</u>	MIIDAE (I	BOWFINS)					
Ami	ia calva (Bowfin)			5						1	
				E	SOCIDAE	(PIKES)					
	x a. <i>vermiculatus</i> Grass pickerel)	46	0.2	23	0.7			33	0.8	25	0.1
				CYP	RINIDAE	(MINNOWS	9				
	Campostoma malum (Central stoneroller)	33	0.5	14	2.1	42	1.4			25	1.1
c.	oligolepis (Largescale stoneroller)	50	3.2	9	7.9	38	4.0			27	3.8
	orinella lutrensis (Red shiner)					8	0.1	7	0.7	3	0.1
c.	venusta (Blacktail shiner)	17	0.7			17	<0.1			9	0.2
c.	whipplei (Steelcolor shiner)	42	1.2	9	1.7	17	0.2			19	0.5
	Cyprinus carpio (Common carp) 8 0.1		5				7	0.1	5	<0.1	
	ognathus nuchalis (Miss. silvery minnow)					17	<0.1	7	0.1	6	0.1

	Luxilus hrysocephalus Striped shiner)	13	2.3	68	6.6	75	2.8	33	0.2	48	2.7
L.	zonatus (Bleeding shiner)	75	8.5	64	2.1	71	9.8			58	8.9
	thrurus fumeus Ribbon shiner)	8	0.1							2	<0.1
L.	umbratilis (Redfin shiner)	54	0.4	18	0.7	33	1.6	80	11.6	44	1.6
	comis biguttatus ornyhead chub)	21	0.7	9	0.1	17	0.2			13	0.4
	Notemigonus soleucas (Golden shiner)			9		8	<0.1	13	2.7	7	0.1
	otropis amnis Pallid shiner)					4	<0.1	7	0.1	2	<0.1
N.	amblops (Bigeye chub)	33	1.7	5	0.1	33	1.2			20	1.2
N.	atherinoides (Emerald shiner)	4	0.3			17	4.8			6	3.3
N.	boops (Bigeye shiner)	75	5.8	59	7.8	67	5.8	27		60	5.7
N.	buccatus (Silverjaw minnow)					21	0.1			6	0.5
N.	greenei (Wedgespot shiner)	16	0.8							5	0.2
N.	heterolepis (Blacknose shiner)	4								1	0.1
N.	nubilus (Ozark minnow)	50	9.8	46	6.4	62	16.8			44	14.0
N.	rubellus (Rosyface shiner)	50	3.1	18	2.1	33	0.5			28	1.2
N.	telescopus (Telescope shiner)	46	2.2	36	4.6	58	4.4			39	3.7
N.	volucellus (Mimic shiner)	12	0.4			17	0.2			8	0.2
Opso (Pu	opoeodus emiliae ugnose minnow)	4						7	0.2	2	<0.1
	nacobius mirabilis Suckermouth minnow)	4	0.4			13	0.1	7	0.1	5	0.2
ery 1	Phoxinus othrogaster (So. redbelly dace)	4		18		17				11	

D:	Pimephales notatus										
	intnose minnow)	63	8.0	41	15.8	58	11.0	60	1.8	55	10.1
P.	promelas (Fathead minnow)					4	<0.1			1	<0.1
P.	tenellus parviceps (E. slim minnow)	13	0.2							3	0.1
P.	vigilax (Bullhead minnow)	17	2.6			4	<0.1	7	0.1	7	0.7
atroi	Semotilus maculatus (Creek chub)	25	0.5	46	0.1	63	0.3	33	0.1	42	0.3
				CATO	STOMIDA	E (SUCKE	<u>RS)</u>				
	arpiodes carpio iver carpsucker)			5						1	
	nyzon oblongus reek chubsucker)	21	0.4	32	0.5	29	0.1	53	1.1	32	0.2
	entelium nigricans thern hog sucker)	50	0.9	32	0.5	46	1.3			35	1.2
	ytrema melanops Spotted sucker)	13	0.1	5	0.1	8	<0.1	13	1.4	9	0.1
	ostoma anisurum Silver redhorse)	8	0.1	5		17	0.1			8	0.1
М.	carinatum (River redhorse)	8	0.2			4	<0.1			3	<0.1
М.	duquesnei (Black redhorse)	38	0.2	27	2.6	33	0.3			27	0.4
M.	erythrurum (Golden redhorse)	30	2.2	18	0.2	25	0.4			20	0.8
М.	macrolepidotu m (Shorthead redhorse)	8	0.1			8	<0.1			5	<0.1
				ICTALU	JRIDAE (O	CATFISHES)				
	meiurus melas Black bullhead)	8	<0.1	9				13	1.5	7	0.1
Α.	natalis (Yellow bullhead)	13	0.1	27	0.2	33	0.3	7	1.5	21	0.3
	lurus punctatus (hannel catfish)			9		12	<0.1	13	0.1	7	<0.1
	Noturus exilis ender madtom)	17	0.1	27		29	0.6			20	0.4
N.	gyrinus (Tadpole madtom)			5	0.1			13	2.6	3	0.1

N.	miurus (Bridled madtom)	38	0.4	5	0.5	17	0.1	7	0.2	17	0.2		
N.	nocturnus (Freckled madtom)	4	<0.1			4	<0.1			2	<0.1		
	lodictis olivaris athead catfish)					4	<0.1			1	<0.1		
				APHREDOD	ERIDAE (PIRATE PE	ERCHES)						
	Aphredoderus sayanus (Pirate perch) 29 0.1 36 0.4 25 0.1 13 10.2 27 0.4												
	CYPRINODONTIDAE (KILLFISHES)												
Fundulus catenatus (Northern studfish) 58 3.1 55 0.1 67 1.9 7 0.5 48 2.1													
F.	notatus (Blackstripe topminnow)					8	0.1			2	0.1		
F.	olivaceus (Blackspotted topminnow	88	5.0	59	6.7	88	2.0	67	5.9	77	2.4		
				POECII	LIIDAE (L	IVE BEARE	ERS)						
	mbusia affinis (Western nosquitofish)	17	0.3	18	0.2	8	0.2	13	2.3	14	0.3		
				ATHERI	NIDAE (SI	LVERSIDE	<u>S)</u>						
	desthes sicculus rook silversides)	42	1.3	27	2.8	13	0.1	7	0.5	23	0.5		
				<u>co</u>	TTIDAE (SCULPINS)							
	ottus carolinae anded sculpin)			9	0.2	25	0.4			9	0.2		
C.	hypselurus (Ozark sculpin)	29	0.2	5						9	<0.1		
				CENTR	ARCHIDA	E (SUNFISE	HES)						
	oplites ariommus Shadow bass)	42	0.2	9	0.2	29	0.9			22	0.7		
	Centrarchus cropterus (Flier)	4	<0.1					7	0.5	2	<0.1		
	ssoma zonatum Banded pygmy sunfish)	8	1.7					13	3.1	5	0.5		
	oomis cyanellus Green sunfish)	25	0.8	59	0.2	38	2.6	67	3.2	45	2.1		
L.	gulosus (Warmouth)	17	0.1	9	0.1			13	5.4	9	0.2		
L.	humilis (Orangespotted sunfish)			5	0.6			7	1.6	2	0.1		

L.	macrochirus (Bluegill)	30	3.7	9	1.3	25	0.9	20	6.8	21	1.8
L.	megalotis (Longear sunfish)	79	7.0	41	7.8	63	6.7	60	5.7	61	6.8
L.	punctatus (Spotted sunfish)	4	<0.1	5		4	<0.1	13	1.9	6	0.1
	opterus dolomieu nallmouth bass)	46	2.6	18	0.1	38	0.7			28	1.2
М.	punctulatus (Spotted bass)	38	0.8	23	0.6	29	0.3	20	0.5	28	0.4
М.	salmoides (Largemouth bass)	13	<0.1	5	0.2	17	0.4	7	0.3	11	0.3
	noxis annularis White crappie)					4	<0.1	7	0.2	2	<0.1
				PE	RCIDAE (PERCHES)					
	mocrypta vivax aly sand darter)	12	0.5			12	0.1			7	0.2
	Etheostoma nioides (Greenside darter)	38	0.2	9		21	0.4			19	0.3
E.	caeruleum (Rainbow darter)	50	4.4	36	1.1	50	7.3			38	6.1
E.	chlorosomum (Bluntnose darter)	8	<0.1			8		13	4.1	7	0.1
Е.	flabellare (Fantail darter)	33	0.9	23		46	3.5			28	2.6
Е.	gracile (Slough darter)	8	0.1			4	<0.1	7	1.8	5	0.1
E.	nigrum (Johnny darter)	17	0.3	18	0.1	21	0.6	13	0.6	18	0.5
E.	proeliare (Cypress darter)	5	2.9	5				20	17.2	9	1.3
E.	punctulatum (Stippled darter)	4								1	
E.	spectabile (Orangethroat darter)	30	0.2	27		58	1.0	20	0.7	35	0.7
E.	stigmaeum (Speckled darter)	30	2.9	9	11.4	21	0.1			17	1.2
E.	zonale (Banded darter)	42	0.9	23	1.2	33	0.8			27	0.8
Pe	rcina caprodes (Logperch)	21	0.1	14	1.1	4	<0.1			11	0.1

P.	sciera (Dusky darter)	21	0.4	9	0.2	21	0.1		14	0.1
P.	vigil (Saddleback darter)	4		5	0.5				2	<0.1
P.	maculata (Blackside darter)	17	0.2	9	0.8	21	<0.1		13	0.1

TABLE 20. Castor River 6-year summary of selected creel parameters reported in the Missouri State-Wide Angler Survey, 1983 - 1988. Because of limited angler contacts (221 anglers during the 6-year period) all data were combined. Parameters involving estimates (pressure, total catch and total harvest) were avoided.

Species Preference Angler	% All Anglers	% All Hours	Spe	Hour cies cific	Angler Quality Rating	Ave Trp	% Species Composition Of Total
Angler	J		CR	HR	(10 = Best)	Len	Catch
Anything	34.9	37.3	1.1	0.7	5.3	4.7	
Bass	31.2	31.8	0.3	0.1	6.6	3.7	29.9
Catfish	18.1	14.3	0.3	0.3	3.5	4.6	5.3
Sunfish	6.3	6.1	2.2	2.2	5.6	1.9	39.7
Crappie	2.7	0.9	0.8	0.8	5.7	4.2	1.0
Shadow Bass	1.8	6.7	0.2	0.2	8.5	6.8	15.8
Sucker	1.8	0.7	8.3	8.3	7.5	3.0	4.2
FW Drum	1.4	0.4	0.3	0.3	7.0	4.0	0.4
Walleye	0.9	1.1	0.0	0.0	5.0	3.5	0.1
White Bass	0.9	0.7	3.9	3.2	5.0	3.0	2.2
Gar	-	-	-		-	-	0.8
Carp	-	-		-	-	-	0.4
Buffalo	-	-	-	-	-	-	0.2
WTD Ave	100	100	1.1	0.6	5.5	4.6	100

TABLE 21. Headwaters Diversion Channel 2-year summary of selected creel parameters reported in the Missouri State-Wide Angler Survey, 1987-1988. Because of wide annual fluctuations and limited angler contacts (182 anglers during the 2-year period) all data were combined. Parameters involving estimates (pressure, total catch, and total harvest) were avoided.

Species Preference Angler	% All Anglers	% All Hours	Spe Spe	cific	Angler Quality Rating	Ave Trp Len	% Species Composition Of Total
			CR	HR	(10 = Best)		Catch
Anything	34.0	36.8	0.8	0.3	4.0	2.0	
Carp	25.5	7.4	0.5	0.5	9.0	3.0	15.0
Crappie	15.4	24.0	0.7	0.5	2.6	3.1	25.2
Catfish	13.3	20.1	0.1	0.1	2.0	5.5	25.0
Bass	10.6	6.7	0.5	0.1	3.9	2.5	6.1
Sunfish	1.1	4.8	17.5	17.5	5.0	0.8	14.6
White Bass	0.1	0.2	0.0	0.0	-	-	0.1
Shadow Bass	-	-	-	-	-	-	0.4
FW Drum	-	-	-	-	-	-	9.8
Gar	-	-	-	-	-	-	3.8
WTD Ave	100	100	0.8	0.3	6.0	3.7	100

TABLE 22. State rank and location of species of conservation concern from the Headwaters Diversion Channel.

C	SERVATION ONCERN SPECIES	STATE RANK	SITE NO.	DATE	STREAM	RM	NO. SPECIMENTS	AUTHORITY
	tropis amnis llid shiner)	SX	3	1940	Hubble Ck.	2.4	1	Pflieger, MDC
N.	Amnis		4	1941	Whitewater R.	21.5	3	Pflieger, MDC
N.	Amnis		U	1941	L. WhWater Ck.	0.0	3	Bauman, A.C.
	nyson sucetta e chubsucker)	S2	Т	1969	Cane Creek	4.8	2	Thomerson, J.E.
E.	sucetta		R	1969	Castor River	5.7	1	Thomerson, J.E.
(A	oetra appendix Am. Brook amprey)	S2	68	1963	Castor River	17.2	20	Pflieger, MDC
h	Notropis neterolepis knose shiner)	S2	S	1969	Castor River	41.6	1	Thomerson, J.E.
parvi	imephales t iceps (E. slim minnow)		64	1941	Castor River	18.8	4	Pflieger, MDC
P.	t parviceps	S2S3	72	1964	Castor River	5.3	9	Pflieger, MDC
P.	t parviceps		75	1984	Castor River	11.6	1	Pflieger, MDC
	astama histrio equin Darter)	S2	72	1996	Castor River	5.3	-	Bruenderman, MDC
	nocrypta vivax y sand darter)		4	1941	Whitewater R.	21.5	10	Pflieger, MDC
A.	vivax	S3	5	1941	Whitewater R.	24.0	5	Pflieger, MDC
A.	vivax		7	1941	l. WhWater Ck.	1.0	6	Pflieger, MDC
Α.	vivax		67	1964	Castor River	13.6	nc	Pflieger, MDC
A.	vivax		72	1984	Castor River	5.3	24	Pflieger, MDC

Α.	vivax		75	Pflieger, MDC							
Percenia shumardi (River darter)		S 3	NO DATA								
Centrarchus macropterus (Flier)			74	1978	Un-named	0.5	1	Pflieger, MDC			
C.	macropteru s	S 3	59	1980	Hawker Creek	3.5 4		Pflieger, MDC			
C.	macropteru s		D	1990	Castor River	4.2 3		Norman, MDC			
C.	macropteru s		E	1990	Castor River	12.2 2		Norman, MDC			
C.	macropteru s		F	1990	Castor River	18.3		Norman, MDC			
C.	macropteru s		J	1990	Crooked Creek	19.5		Norman, MDC			
C.	macropteru s		N	1990	Whitewater R.	15.2		Norman, MDC			
Opsopoeodus emiliae (Pugnose minnow)			3	1940	Hubble Creek	2.4	2	Pflieger, MDC			
0.	emiliae	S4	26	1941	Crooked Creek	20.5	1	Pflieger, MDC			
Polyodon spathula (Paddlefish)		S 3	A	1990	Diversion Ch.	1.5	2	Norman, MDC			
Hognathus nuchalis (Mississippi Silvery Minnow)		S 3		1990	Whitewater R.	NO DATA					

^{*}SX = Extirpated: Element is believed to be extirpated from the state

^{*}S1= Critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state (typically 5 or fewer occurrences or very few remaining individuals

^{*}S2= Imperiled in the state because of rarity or because of some factor (s) making it very vulnerable to extirpation from the state. (6 to 20 occurences or few remaining individuals or acres)

^{*}S3= Rare and uncommon in the state. (21 to 100 occurrences)

^{*}S4= Widespread, abundant, and apparently secure in state, with many occurrences, but the species is of long-term concern. (usually more than 100 occurrences)

TABLE 23. Species list and status (state and federal) of naiades collected in the Headwater Diversion Basin, Missouri. From the MDC Natural Heritage data base.

	Species	Common Name	Castor River	White- Water River	Crooked River	
	Anodonta imbecilis	Paper pondshell				
	A. g. grandis	Floater		X		
	Strophitus u. Undulatus	Squawfoot	X	X	X	
S2	Alasmidonta margineta	Elktoe		X	X	
	Lasmigona complaneta	White heelsplitter		X	X	
	L. costata	Fluted shell	X	X	X	
	Megalonaias nervosa	Washboard	X	X	X	
	Tritogonia verrucosa	Buckhorn	Х	X		
	Quadrula quadrula	Mapleleaf		X		
	Q. metanevra	Monkeyface	Х	X	Х	
	O. pustulosa	Pimpleback	Х	X		
	Amblema p. plicata	Threeridge	Х	X	х	
	Fusconaia flava	Wabash pigtoe	Х	X	х	
	Pleurobema sintoxia	Pigtoe			х	
	P. coccineum	Round pigtoe	Х			
	Elliptio dilatata	Lady finger	Х	X	X	
S2S3	E. c. crassidens	Elphant ear	Х			
	Ptychobranchus occidentalis	Kidney shell	Х	X		
S1S2*	Cyprogenia aberti	Western fanshell	Х			
	Actinonaias l. carinata	Mucket	Х	X	X	
S1	Obovaria jacksoniana	Southern hickorynut	X	X	Х	
	Truncilla truncata	Deertoe		х		
	Leptodea fragilis	Fragile papershell	Х	х	х	
	Potamilus alatus	Pink heelsplitter	Х			
	P. purpuratus	Bleufer	Х	х	х	
	Toxolasma parvus	Lilliput	Х		х	
S1S2	Ligumia recta	Black sandshell	Х	х		
	L. subrostrata	Pond mussel		Х	Х	
	Villosa i. iris	Rainbow	Х			
	V. l. lienosa	Little spectacle case	Х		Х	
	Lampsilis teres	Yellow sandshell	X	X	X	
	L. r. luteola	Fat mucket	Х	Х	х	
	L. ventricosa	Pocketbook	X	X	X	
	L. r. breviculus	Ozark brokenray	Х	X	X	
S1	Epioblasma triquetra	Snuffbox	X		1	
S1*E	E. f. curtisi	Curtis peerly mussel	X			
	Corbicula leana	Asiatic clam		х		

^{*=}Federally listed

TABLE 24. Species list and relative abundance of crayfish species collected in the Headwater Diversion Basin, Missouri. (From MDC NaturalHeritage data base)

		Number of crayfish collected								
Crayfish Species	Castor	White- Water	Crooked	Hubble	Hawker Creek	Clubb Creek	Totals			
	River	River	River	Creek			No.	% Comp		
Cambarus diogenes	1						1	0.2		
Orconectes luteus	246	5	50	8			309	77.4		
O. palmeri		3	23	6			32	8.0		
O. virilis		3		3			6	1.5		
O. punctimanus	13		1			7	21	5.3		
Procambarus acutus	4		2	3			9	2.3		
P. clarkii					1		1	0.2		
P. viaeveridus	13						13	3.3		
Fallicambarus fodiens	7						7	1.8		
Total numbers sampled	284	11	76	20	1	7	399	100		
No. of sample sites	7	1	4	3	1	1		1		
Total effort (hrs)	9.7	0.5	4.4	1.1	0.4	0.4	16.5	1		
Catch rate	29.3	22.0	17.3	18.2	2.5	17.5	24.2			

TABLE 25. Relative abundance of taxonomic classes of benthos collected in the Headwater Diversion Basin, Missori. (From MDC Natural Heritage data base)

		stor Ri 6 & Rl		Wh	itewate RM 36		C	Crooked Ck. <u>RM 22</u>		<u>Basin Totals</u>		
Class	No. Taxa	No./ 10 ft ²	% Comp	No. Taxa	No./ 10 ft ²	% Comp	No. Taxa	No./ 10 ft ²	% Comp	No. Taxa	Ave#/10 ft ²	% Comp
Annelida	2	109	17.6	1	22	1.3	2	4	0.5	3	58	6.2
Amphipoda				1	1	1</td <td>2</td> <td>1</td> <td>0.1</td> <td>2</td> <td><1</td> <td><.1</td>	2	1	0.1	2	<1	<.1
Isopoda				1	4	0.2				1	1	0.2
Decapoda	1	3	0.5	1	<1	<.1	1	2	0.2	1	2	0.1
Ephemeroptera	23	176	28.3	17	360	21.4	19	480	61.7	27	306	32.4
Odonata	6	5	0.8	4	2	0.1	3	2	0.3	7	3	0.3
Plecoptera	8	16	2.6	11	121	7.2	10	25	3.2	21	46	4.9
Hemiptera	1	1	0.2	1	1	<.1				1	1	<.1
Megaloptera				2	8	0.5	2	3	0.3	3	3	0.2
Trichoptera	14	23	3.7	16	434	25.9	11	81	10.4	19	148	15.7
Lepidoptera	1	1	0.1				1	<1	<.1	1	<1	<.1
Coleoptera	12	54	8.6	9	55	3.3	7	16	2.1	14	44	4.7
Diptera	9	207	33.3	12	664	39.6	9	162	20.8	13	317	33.6
Gastropoda	4	5	0.8	2	1	0.1	1	1	0.2	4	3	0.3
Plecypoda	1	22	3.5	1	1	0.1				2	10	1.1
Miscellaneous	1	1	0.1	4	3	0.2	2	2	0.2	4	1	0.3
Totals	83	623		83	1,677		70	779		123	943	
No. of samples		7			4			4			15	
No. of organisms		4,342			6,703			3,112			14,157	

